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Development of Natural Science Learning Designs to Improve The Character of Pancasila Students in Critical and Creative Reasoning Aspects

Rinnanik[1*], Rachmawati Novaria[2], Agus Mukholid[3], Aditia Fradito[4]

[1] Management Department, Management Faculty, STIE Lampung Timur, Lampung, Indonesia.
[2] State Administration Department, Social and Political Science Faculty, Universitas 17 Agustus, Indonesia.
[3] Physical Education Program, Health and Recreation of Sports Science Faculty, Universitas Sebelas Maret, Surakarta, Indonesia.
[4] Islamic education management, Tarbiyah and Teacher Training Faculty, UIN Raden Intan Lampung, Lampung, Indonesia.

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Corresponding Author:
Rinnanik
rinnanik17707@gmail.com

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Abstract: The application of values in learning activities is an effort to strengthen student character. This effort is in line with the Ministry of Education and Culture's commitment to realizing Pancasila Students. Pancasila students are the embodiment of Indonesian students who have good character with competencies that can compete globally and reflect the noble values of Pancasila in every behavior. The results of a preliminary study on science learning activities at Arafah Elementary School show the low level of Pancasila student character in the critical and creative reasoning aspects of students. There is a need for alternative learning designs that are able to accommodate the character of Pancasila students in the aspects of students' critical and creative reasoning skills. This research is development research using the Learning Development Cycle (LDC) model. Model cycle This research includes the scope, creation, user experience, meta stages evaluation, and evaluation. This research aims to describe the development product in the form of a science learning design in improving the character of Pancasila students in the aspects of critical and creative reasoning. The product description is reviewed based on the data obtained, namely the results of product validation provided by experts with valid criteria if it reaches the valid-very valid category, data on effectiveness results is reviewed from the achievement of critical and creative reasoning indicators through pretest and posttest with effective criteria if it reaches the medium- high, and practicality is reviewed based on the observer's assessment of implementation with practical criteria if it reaches the practical-very practical category.

Keywords: Creative; Critical reasoning; Natural science learning design; Pancasila student character

Introduction

Education has an important role in preparing good quality Human Resources (HR). In preparing good quality human resources, education in Indonesia is faced with one of the demands, namely moral decadence and the crisis of national character among students. Setiarsih (2016) stated that there are indications that show a crisis of national character, including a decline in mutual cooperation activities, deliberation to reach consensus, and a decline in respect for one another. The decline in various social activities often occurs in the younger generation. This condition can cause the disintegration of the nation and the erosion of identity national. Muhlisin et al. (2021) stated that in learning activities there are several indications that show the need for character improvement. These indications can be seen from several students' activities during learning activities, including imitating activities during exams, assignments not submitted on time, low ability to work

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together, and lack of ability to analyze problems. Based on these conditions, it can be concluded that the national character crisis is a fundamental problem that needs to be resolved through education to produce good quality human resources.

The application of values in learning activities is an effort to strengthen the character of students, in line with the Vision and Mission of the Ministry of Education and Culture in realizing Pancasila Students as stated in Minister of Education and Culture Regulation Number 22 of 2020 concerning the Strategic Plan of the Ministry of Education and Culture for 2020-2024. Pancasila students are essentially the embodiment of Indonesian students who have good character as lifelong students with competencies that can compete globally and all their behavior reflects the noble values of Pancasila (Kemendikbud, 2020). Contained in Minister of Education and Culture Regulation Number 22 of 2020 that Pancasila Students have six main characteristics, namely 1) faith, devotion to God Almighty, and noble character, 2) global diversity, 3) working together, 4) independence, 5) critical reasoning, and 6) creative.

The results of a preliminary study on science learning activities at SDIT Arafah Bekasi show that students' low critical and creative reasoning abilities are a learning problem that needs to be corrected at SDIT Arafah Bekasi. This low aspect is indicated by a lack of ability to analyze and solve problems and provide original answers to questions. The low level of this aspect is caused by learning activities which tend to be teacher-centred. The results of interviews with science teachers at SDIT Arafah Bekasi show that science learning activities at SDIT Arafah Bekasi use a model that is adapted to the characteristics of the learning material. The teacher carries out learning activities through several learning steps in accordance with the model used. However, through several steps, this learning model has not been able to achieve learning objectives such as students' critical and creative reasoning skills. This indicates a lack of effectiveness of the learning carried out. The solution that can be taken to solve this problem is to increase the effectiveness of learning steps.

Aspects of critical and creative reasoning are included in the Pancasila Student profile and are related to the skills that must be possessed in the 21st century. This is in accordance with Kumara (2018) statement that learning planning needs to link 21st century skills with national character. Mardhiyah et al. (2021) states that 21st century learning is emphasized on the student center approach as an effort to create students as human resources who have thinking skills, namely critical thinking, problem solving, creative and innovative, metacognitive, communicating, working together, and information literacy. This becomes the basis of that character.

Pancasila students in the aspects of critical and creative reasoning at SDIT Arafah Bekasi are an urgency that needs to be followed up. Sayekti (2015) explains that the internalization of strengthening character education can be done through science learning. This is because science learning essentially has three dimensions, namely as a process, product and scientific attitude (Vitasari, 2017). These three dimensions are related to each other and cannot be separated. To get a scientific product, a scientific process is needed. The scientific process includes scientific attitudes in students. The essence of science is in line with the application of good values to science learning to strengthen the character of students. The essence of science as an attitude in a scientific process needs to give rise to values that can train the character of students. These values include high curiosity, logical and critical thinking, high creativity, innovation, honesty, responsibility, independence, and not giving up easily.

Efforts to realize the Pancasila student character through learning activities require selecting appropriate learning and instructional models. The learning steps chosen must integrate character education in it so that it is able to build and strengthen the Pancasila Student character in students. Sugiyono (2021) states that learning design is a procedure that includes the processes of analysis, design, development, implementation and evaluation to measure the level of success of learning activities.

Learning design helps make it easier for educators or instructional designers to plan learning activities that are effective, efficient and in line with objectives. Through designs designed by educators or designers, active and interactive communication patterns and learning activities can be created between students and educators (Batubara, 2018). Learning instructional design is able to improve the quality of learning, such as the research results of Ayu et al. (2016) that developing learning designs by applying several graphic arts principles in visual communication design for multimedia really helps the learning process. Susilo et al. (2016) in his research concluded that learning design has a significant effect on the development of student attitudes. Ghufron's research (2017) states that the development of cultural values-based learning designs is able to optimize and increase the effectiveness of the transformation of cultural values to students. These various studies have concluded that developing learning design can increase the effectiveness of learning in achieving learning goals.

Previous research and studies referring to design development. This instructional learning is the basis that

learning instructional design is important to develop as an effort to solve a learning problem, for example in improving the character of Pancasila students. Based on this, research was carried out on the development of instructional design for science learning to improve the character of Pancasila students in the critical and creative reasoning aspects of students at SDIT Arafah Bekasi.

Method

This research is development research that produces products in the form of learning designs. Development research produces a certain product and the product's effectiveness is tested (Sugiyono, 2021). This research refers to the Learning Development Cycle (LDC) model (Siemens, 2005) and was carried out from the design stage to limited product testing. This research model includes five phases, namely 1) scope, 2) creation, 3) user experience, 4) meta evaluation, 5) evaluation. The research cycle for LDC model development can be seen in Figure 1.

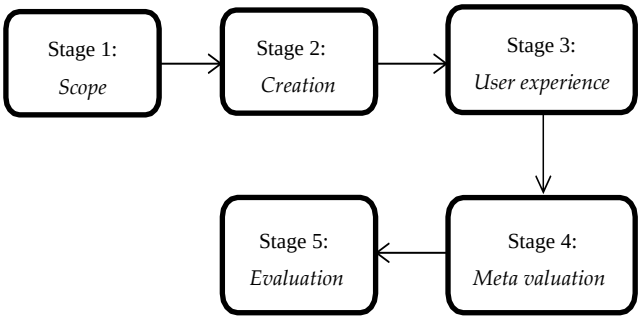

Figure 1. Learning development cycle (Siemens, 2005)

Operationally, the scope stage includes survey research and analyzing learning systems and tools. This stage is carried out to get an overview of the science learning system and formulate an implementation plan for developing learning design products. The creation stage includes designing and developing a learning design draft including objectives, theoretical foundations, instructional steps, social systems, reaction principles, supporting systems, instructional impacts and accompanying impacts, supporting learning tools, namely lesson plans, learning materials and evaluation sheets, and is carried out delivery to users. The next stage is user experience, namely conveying the product developed to science subject teachers through discussion activities. The results of this stage are a response to the learning design plan. Meta evaluation takes the form of product validity assessment activities in terms of content and construct validity provided by experts. The evaluation stage includes implementation activities through limited product trials using a one group pretest-posttest trial design and final product revisions that refer to the overall evaluation results.

This research was carried out in January-May 2022 at SDIT Arafah Bekasi. The subjects of this research were 22 class IV students at SDIT Arafah Bekasi. Data collection techniques include non-test techniques in the form of questionnaires to obtain validity and practicality data, as well as tests (pretest and posttest) to obtain effectiveness data. Data collection instruments include validation assessment instruments to measure product validity, pretest-posttest question sheets to measure product effectiveness in limited trial activities, and instructional step implementation questionnaire sheets to measure product practicality. The resulting data is in the form of qualitative data, namely suggestions from validators and quantitative data in the form of validation results, implementation assessment results, and test results. The validation data is analyzed by referring to the assessment given by each expert. Guidelines for giving scores for each aspect can be seen in Table 1.

Table 1. Guidelines for Providing Validation Scores

Score	Category
1 (one)	Not feasible
2 (two)	Not worth it
3 (three)	Decent enough
4 (four)	Worthy
5 (five)	Very Worth It

The results of the expert assessments are then analyzed by referring to the average score given by each expert on each aspect and the total average. The total validity average score obtained was categorized into qualitative data by referring to standard score guidelines 5 (Widoyoko, 2016). A product is declared valid if it reaches the valid or very valid category based on the categorization guidelines which can be seen in Table 2.

Table 2. Guidelines for Validity Assessment Categories (Widoyoko, 2016)

Score Intervals	Category
$X > 4.2$	Very Valid
$3.4 < X \leq 4.2$	Valid
$2.6 < X \leq 3.4$	Fairly Valid
$1.8 < X \leq 2.6$	Less Valid
$X \leq 1.8$	Invalid

After obtaining a product that is declared valid, it continues with the implementation stage, namely limited product testing to measure the effectiveness and practicality of the product. The limited trial used a one group pretest-posttest design with a question sheet that integrated the indicators being measured. The pretest and posttest results were then analyzed to determine the

magnitude of the improvement before and after treatment. The pretest and posttest results were analyzed using the following N-Gain formula calculation.

The calculation results are then classified according to the N-Gain category to obtain a description of the product's effectiveness. A product is declared effective if it reaches the moderate to high improvement category. Guidelines for categorizing N-Gain can be seen in Table 3.

Table 3. N-Gain Score Categorization Guidelines (Hake, 1998)

N-Gain Score	Category
$G \geq 0.70$	Tall
$0.30 \leq G < 0.70$	Currently
$G < 0.30$	Low

Practicality is obtained through assessing the implementation of learning instructional steps in terms of teacher activities and student activities. The results of the implementation assessment are then calculated as percentages using the following formula.

Table 4. Practicality Categorization Guidelines (Gumilang et al., 2019)

Percentage	Category
80% - 100%	Very practical
61% - 80%	Practical
41% - 60%	Quite practical
21% - 40%	Not practical
1% - 20 %	Impractical

Result and Discussion

The results of this development research are science learning designs to improve the character of Pancasila students in the aspects of critical and creative reasoning. This science learning design includes reading, questioning, group discussions, presenting and concluding. The resulting learning design consists of components that include aspects of learning design and details of learning instructional steps. The resulting learning design components can be seen in Table 5. Aspects of the instructional steps in Table 5 are further detailed to show each learning activity more clearly.

Table 5. Learning Design Components

Related Aspects	Description
Orientation and characteristic	Helping students express ideas and express patterns of behavior that enable students to develop into individuals who have critical and creative reasoning skills.
Instructional steps	Reading, Asking (Questioning), Group discussion (Discussing), Presenting (Presenting), Concluding (Concluding)
Supporting Theory	The learning instructional design was developed with Cognitivism, Constructivism, Connectivism based on the theories of cognitivism, constructivism, and
Social system	Learning activities in accordance with syntax help students improve critical reasoning skills, increase creativity.
Reaction principle	The learning activities contained in each stage of learning instructional design facilitate the creation of.
Support system	The learning instructional design support system

This science learning design has been designed in accordance with the objectives to be achieved, namely improving the character of Pancasila Students in the aspects of critical and creative reasoning. Each instructional step in Table 6 is prepared by integrating activities that can develop the character of Pancasila Students, especially in the aspects of critical and creative reasoning. In this way, the application of this science learning design can provide training so that it can improve the character of Pancasila students in the aspects of critical and creative reasoning.

The validity of the learning design components and details of the learning instructional steps in Tables 5 and 6 is measured through validation activities in terms of content validation and construct validation by validators. The results of content validation can be seen in Table 6.

Table 6. Results of Content Validation of Science Learning Design

Assessment Aspects	Average Score
Rationality of goals	3.85
Instructional steps	4.13
Social system	4.07
Reaction principle	4.00
Support System	4.00
Instructional and accompanying impacts	3.90
Total average	4.00 (Valid)

The results of the expert assessment of the feasibility of the learning instructional design content in Table 7 show that the average score for the feasibility of the design content was 4.00 with a valid category based on the validity categories in Table 2. The results of the feasibility assessment in terms of the suitability of the

content show that the learning instructional design can implemented at the trial stage. The validity of this science learning design is also seen from construct validity. The results of construct validation can be seen in Table 7.

Table 8 shows the average feasibility score obtained in terms of construct feasibility with a total average score of 4.18 with the valid category based on the validity category guidelines in Table 2. The results of the average construct feasibility value obtained indicate that the learning instructional design developed is valid and can be applied at the trial stage.

Table 7. Results of Construct Validation of Science Learning Design

Assessment Aspects	Average Score
Conformity between learning design stages and learning objectives not contradictory.	4.2
The relationship between supporting theories and mutual learning characteristics support.	4.2
Understanding the principles of supporting theories with objectives and learning characteristics are not contradictory.	4
The interrelationship of each stage of learning design is internal to each other support.	4.2
The activities of teachers and students at each stage of learning design are mutual related.	4.4
The use of learning resources to achieve mutually supportive goals.	4
The pattern of interaction between students and teachers is mutually supportive.	4.2
Teacher behavior in providing motivation and guidance to students reflected in the learning design stages.	4.2
Total average	4.18 (Valid)

The effectiveness of science learning design in improving the character of Pancasila students in the aspects of critical and creative reasoning was obtained through a limited trial stage in the form of pretest-posttest activities using question instruments that integrated indicators from these two aspects. The trial result data was analyzed using a normality test to determine whether the data was normally distributed or not normally distributed. The results of the normality test show that the pretest value data obtained a calculated L (Lo) of 0.138 and the posttest Lo obtained is 0.167 with L table of 0.190, so the results of the normality test show that Lo < Ltable is 0.138 < 0.190 and 0.167<0.190. The results obtained from the normality test based on the Liliefors criticality table can be concluded that the data is normally distributed and parametric statistical analysis can be carried out. Next, a T test was carried out to determine the difference between the pretest results (before treatment) and the posttest results (after treatment). The T test used in this research was a paired T-test with α of 5% and a level of freedom of 21. The T table value = 2.080 and calculated T = -9.4604. The results of the T test are then interpreted with reference to the Ho acceptance criteria, where if - T table < T count < T table then the obtained value of T count is not in the area between T table and – T table.

The differences between the pretest and posttest results were analyzed through the N-Gain test to assess the increase in students' critical and creative reasoning skills based on the scores from the pretest and posttest results. The N-Gain test is carried out by calculating the pretest and posttest results using the N-Gain formula with the help of the Microsoft Excel application. The results of the N-Gain score can be seen in Table 8.

Table 8. N-Gain Test Results

Sample Number	N-Gain Score	Category
1	0.25	Low
2	0.22	Low
3	0.38	Currently
4	0.74	Tall
5	0.34	Currently
6	0.63	Currently
7	0.35	Currently
8	0.32	Currently
9	0.26	Low
10	0.63	Currently
11	0.15	Low
12	0.40	Currently
13	0.19	Low
14	0.22	Low
15	0.22	Low
16	0.29	Low
17	0.60	Currently
18	0.31	Currently
19	0.67	Currently
20	0.67	Currently
21	0.10	Low
22	0.78	Tall
Average	0.40	Currently

The results of the N-Gain test from student pretest and posttest score data in Table 9 show that the average N-Gain score is 0.40 in the medium category if based on the N-Gain score categorization guidelines contained in Table 3. N-Score obtained -The gain can be interpreted as good but not optimal because it is influenced by several factors. Table 9 shows nine samples that got N-Gain scores in the low category, eleven samples with N-Gain scores in the medium category, and two samples with N-Gain scores in the high category. The large

number of samples that received low N-Gain scores was influenced by the limitations of online learning activities, namely the existence of network problems for students so that there were students who were less able to receive directions and information well.

The practicality of learning instructional design is carried out to determine the level of implementation of the learning instructional design developed when it is implemented in learning activities. The practicality of learning instructional design is assessed based on the results of observations of the implementation of learning activities by observers and student response questionnaires. The results of the implementation of instructional steps in terms of teacher activities based on observer assessments are presented in Table 9.

Table 9. Implementation Assessment Results Teacher Activities

Learning Phase	Total Score
Introduction	69
Core	182
Closing	42
Accuracy of time allocation	11
Total score	304
Percentage	88.12 (Very Practical)

The implementation of the instructional steps in the learning instructional design developed is also reviewed from student activities while participating in learning activities. The results of the assessment of the implementation of instructional steps in terms of student activities are presented in Table 10.

Table 10. Implementation Assessment Results Student Activities

Learning Phase	Total Score
Introduction	69
Core	174
Closing	39
Accuracy of time allocation	11
Total score	293
Percentage	84.93 (Very Practical)

Learning activity assessments are assessed based on teacher and student activities during the learning activity. The results of the teacher activity assessment show a percentage of 88.12% in the very practical category and student activity with a percentage of 84.93% in the very good category based on the practicality categorization guidelines in Table 4. So it can be concluded that the science learning design developed is stated to be practical.

Based on the analysis of validity, effectiveness and practicality in this development research, the results showed that the product in the form of a science learning design was declared valid, effective and practical in improving the character of Pancasila Students in the aspects of critical and creative reasoning. The science learning design was declared valid by obtaining content and construct validation results in the valid category. This validation result can be obtained because the learning design process is carried out by referring to the learning objectives and needs that have been analyzed first. This is in accordance with the opinion of Mardiana et al. (2013) that the learning design process is directed at needs analysis and attempts to resolve these needs. Nadlir (2013) in his research also stated that learning design is a projection of what the teacher will implement in learning activities. Through a systematic learning design process, learning components can be well coordinated so as to optimize learning activities.

Another aspect that makes the results of this development research valid is the completeness of the learning design components which consist of goal orientation, instructional steps, social systems, reaction principles, support systems, instructional impacts, as well as accompanying and measurable impacts through validation activities by experts. As stated by Ghufron (2017), learning design is based on psychological characteristics and theories that are appropriate to the objectives and includes several components in the form of rational objectives, instructional steps, social systems, reaction principles, support systems, instructional impacts, and accompanying impacts. The learning steps consist of reading, questioning, group discussions and presenting and concluding are developed based on student needs and the objectives to be achieved in this research. The reading activity in question is critical reading which involves an analysis process so that it can practice critical reasoning skills (Sofiya, 2014). This is supported by group discussion activities which train collaboration skills, creativity, responsibility and develop mutual respect (Sutami et al., 2013). This study is relevant to this development research so that it can produce valid products.

This development research succeeded in developing a science learning design which was declared effective based on the results of limited product application trials. These results show an increase in the character of Pancasila Students in the aspects of critical and creative reasoning with an N-Gain score of 0.40 in the medium category. The magnitude of the increase in the character of Pancasila Students in the aspects of critical and creative reasoning is influenced by the superior characteristics of student-centered science learning design. Learning activities that actively involve students can influence student behavior. Nurhadi (2020) with a statement that is in line with the theory of cognitivism that through continuous learning activities

will produce changes in students' behavior patterns and knowledge. Each learning activity contained in the instructional steps internalizes the character of Pancasila students so that it helps the learning process in improving that character. This is in accordance with the research objective, namely improving the character of Pancasila students in the aspects of critical and creative reasoning. In line with previous research conducted by Ayu et al. (2016) that learning designable to help the learning process. This is in accordance with the research results of Istianah et al. (2021) that the integration of Pancasila character values which are familiarized through learning activities forms an academic system and values that are in accordance with the Pancasila ideology. Ghufron (2017) also stated that learning design by internalizing cultural values can increase the effectiveness of learning activities in achieving learning goals. Thus, learning activities that apply science learning designs are effective in improving the character of Pancasila students in the aspects of critical and creative reasoning.

The description of the activities in this learning design shows that there is interaction between teachers and students so that patterns of interaction are formed in learning activities as well as links between teacher and student activities during learning activities. Batubara (2018) states that instructional design that is designed in accordance with learning objectives can create active and interactive communication patterns and learning activities between students and educators.

The results of the review based on previous research can be used as a basis for the conclusion that this development research has succeeded in developing science learning designs to improve the character of Pancasila students in the aspects of critical and creative reasoning. These results can answer the objectives of this development research and produce products that are valid, effective and practical.

Conclusion

The results of the research and discussion presented by researchers regarding the development of instructional design for science learning to improve the character of Pancasila students at SDIT Arafah Bekasi can be concluded that; The science learning design to improve the character of Pancasila students in the aspects of critical and creative reasoning at SDIT Arafah Bekasi was declared valid based on the results of a feasibility assessment by experts with a score of 4.00 in content validity and 4.18 in construct validity. Science learning design was declared effective in improving the character of Pancasila students in the aspects of critical and creative reasoning at SDIT Arafah Bekasi with an N-Gain score of 0.40 in the medium category.

Author Contributions

Rinnanik, design the research, collect data; R. Novaria, analyze data; A. Mukholid, Writing article; A. Fradito, Make instruments.

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Conflict of Interest

There is no conflict interest in this research.

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